Adopted March 22, 1984
Amended May 20, 1987

WASTEWATER FACILITIES DESIGN STANDARDS

CHAPTER 14

WASTEWATER TREATMENT WORKS

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Adopted March 22, 1984
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14.9 LABORATORY

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APPENDIX I RECOMMENDED PROCESS PIPING COLOR CODING

APPENDIX II RECOMMENDED LABORATORY GUIDELINES

Adopted March 22, 1984
Amended May 20, 1987

IOWA WASTEWATER FACILITIES DESIGN STANDARDS

CHAPTER 14

WASTEWATER TREATMENT WORKS

14.1 GENERAL

14.1.1 Applicability

This chapter is applicable to construction, installation or modification of any disposal system required to obtain a construction permit from this Department under Iowa Code section 455B.183 and rule 567 Iowa Administrative Code (IAC) 64.2.

14.1.2 Variances [subrule 567 IAC 64.2(9)"c"]

When engineering justification satisfactory to the Director is provided substantially demonstrating that variation from the design standards or siting criteria will result in either: at least equivalent effectiveness while significantly reducing cost, or improved effectiveness, such a variation from design standards or siting criteria may be accepted by the Director.

A present worth analysis may be necessary where a significant cost reduction must be demonstrated.

14.1.3 Explanation of Terms

The terms "shall" or "must" are used in these standards when it is required that the standard be used. Other terms such as "should" and "recommended" indicate desirable procedures or methods which should be considered but will not be required.

The term "or equal" is used in these standards when an alternative of substantially equivalent effectiveness or improved effectiveness may be permitted without a variance when engineering justification satisfactory to the Director is provided and accepted.

The term "viable" means a disposal system which is self-sufficient and has the financial, managerial, and technical capability to reliably meet standards of performance on a long term basis, as required by state and federal law.

The term "raw wastewater" means wastewater before it receives treatment and process return flows from treatment units at the plant are absent.

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The phrase "alternative technology" means a technology that has been proven effective and reliable for its intended purpose in a substantial number of applications, but it may or may not be commonly used and is not included in the Iowa Wastewater Facilities Design Standards or Ten States Standards.

The phase "innovative technology" means a technology that has not been proven effective and reliable for its intended purpose in a substantial number of applications, but it has the potential to be successful based on Section 14.4.3.

14.2 PLANT SITING

14.2.1 General

The engineering report or facilities plan required by Chapter 11 of these Standards shall address site selection. All sites must comply with all applicable siting requirements of this Department and other state and local agencies.

14.2.2 Site Survey [subrule 567 IAC 60.4(1)"c"]

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The applicant's engineer must submit the following information for a site survey.

- Engineering Report or Facilities Plan
- Construction Permit Application Forms, DNR 28:
  - Schedule A - General Information
  - Schedule F - Treatment Project Site Selection
  - Schedule G - Treatment Project Design Data

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14.2.3 Separation Requirements [subrule 567 IAC 64.2(3)]

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The following separation distances from treatment works; disposal fields; lagoons; holding or flow-regulating basins; sludge processing or storage units; pumping stations; or devices, basins, tanks or buildings installed for the purpose of treating, stabilizing, or disposing of sewage, industrial waste, or other wastes shall apply. The separation distance from lagoons shall be measured from the water surface.

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a. 1,000 feet from the nearest inhabitable residence, commercial building, or other inhabitable structure. If the inhabitable or commercial building is the property of the owner of the proposed treatment facility, or there is written agreement with the owner of the building, the separation criteria shall not apply. Any such agreement shall be filed with the county recorder and recorded for abstract of title purposes, and a copy submitted to the Department.

b. 1,000 feet from public shallow wells.

c. 400 feet from public deep wells.

d. 400 feet from private wells.

e. 400 feet from lakes and public impoundments.

f. 25 feet from property lines and right-of-way.

When the above separation distances cannot be maintained for the expansion, upgrading or replacement of existing facilities, the separation distances shall be maintained at no less than 90% of the existing separation distance of the site, provided that no problem has existed or will be created.

If practicable, a property line separation distance of 300 feet from treatment works structures is recommended.

Separation Distance Exceptions - Exceptions to the above separation distances apply for the following:

1) Remote Pumping Stations or Additive Feed and Storage Facilities in the Collection System - The above separation distances from the nearest inhabitable residence, commercial building, or other inhabitable structure; public and private wells; lakes and public impoundments; property lines and right of way to pumping stations or additive feed and storage facilities at a site which is remote from the treatment plant are recommended. See also Section 13.2.3 of the Iowa Wastewater Facility Design Standards. The separation distance shall not be less than 75 feet from a public well or 50 feet from a private well.

2) Remote Subsurface Wet Weather Flow Equalization Basins in the Collection System - The above separation distances from the nearest inhabitable residence, commercial building, or other inhabitable structure; public and private wells; lakes and public impoundments; property lines and right of way to a subsurface wet weather flow equalization basin at a site which is remote from the treatment plant are recommended. The separation distance shall not be less than 75 feet from a public well or 50 feet from a private well.

3) Office or Laboratory Building - The above separation distances from the nearest inhabitable residence, commercial building, or other inhabitable structure; public and private wells; lakes and public impoundments are recommended.

4) Wetted Disposal Area - Chapter 21 of the Iowa Wastewater Facilities Design Standards establishes the site separation criteria from the wetted disposal area for land application of treated wastewater.

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5) Treatment Works for a Water Plant, Boiler or Cooling Tower Blow Down or a Building Housing an Industrial Physical/Chemical Treatment Process - The above separation distances from the nearest inhabitable residence, commercial building, or other inhabitable structure; public and private wells; lakes and public impoundments to treatment works for a water plant (except lagoons storing wastes that exceed the Life Time Health Advisory Level Standards), boiler or cooling tower blow down holding or flow-regulating basins, or a building housing an industrial physical/chemical treatment process are recommended. However, all stripping towers for wastewater treatment regardless of the enclosure shall meet the 1,000 feet separation distance from the nearest inhabitable residence, commercial building, or other inhabitable structure. The separation distance shall not be less than 75 feet from a public well or 50 feet from a private well.

14.2.4 Flood Protection

a. The treatment works structures, electrical and mechanical equipment shall be protected to the level of a flood equivalent to the one percent annual chance ("100-year") flood plus one foot.

b. Treatment works should remain fully operational and accessible during the "100-year" flood, if practicable; lesser flood levels may be used dependent on local situations, but in no case shall less than a four percent annual chance ("25-year") flood be used. This applies to new construction and should be considered for existing facilities undergoing major modification.

c. Wastewater treatment facilities shall not be located to conflict with encroachment limits on the floodway. The establishment of these encroachment limits is described in rule 567 IAC 75.4(455B).

d. It is also recommended that structures be offset one hundred feet or twice the width of the river or stream measured from top of bank to top of bank, whichever distance is less, unless a greater distance is required under rule 567 IAC 72.6 (455B).

14.3 QUALITY OF EFFLUENT

This Department establishes the effluent limitations for each wastewater discharger. Effluent limitations for existing wastewater dischargers are available from the Department. The effluent limitations for new dischargers or significantly modified dischargers are established by the Department upon request. The minimum degree of treatment shall be standard secondary treatment for municipal facilities and the industrial effluent guidelines as defined by Department rules and Federal regulations for industrial facilities. A higher degree of treatment will be required if the minimum degree of treatment requirements would violate state water quality standards, a total maximum day load limit if applicable or any limit from anti-degradation policies and implementation

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procedures which may apply. Design engineers must obtain effluent limitations prior to preparation of the engineering report or facilities plan. The facilities must be designed to meet average effluent limitations in the operation permit during any 30-day period and to not exceed maximum and seven-day average effluent limitations.

14.4 DESIGN

14.4.1 General

14.4.1.1 Type of Treatment

Careful consideration shall be given to the type of treatment selected in the engineering report or facilities plan as required by Section 11.2.9.5.

14.4.1.2 Industrial Wastes

Consideration shall be given to the type and effects of industrial wastes on the treatment process. It may be necessary to pretreat industrial wastes prior to discharge to the sanitary sewer system.

14.4.1.3 Prohibited Wastes

The following wastes shall not be discharged to treatment facilities without assessment of their effects upon the treatment process or discharge requirements in accordance with state and federal law:

a. Any toxic chemicals or added heat which may inhibit biological or bacteriological processes.

b. Any strong oxidizing agents or disinfectants in quantities sufficient to inhibit the growth of microorganisms.

c. Metal plating wastes or other toxic wastes containing heavy metals and/or toxic or noxious inorganic chemicals, such as cyanide, reduced sulfur compounds, arsenic and selenium.

d. Detergent wastes or other wastes containing excessive phosphorous or surfactants.

e. Plastics, pharmaceutical wastes and/or other synthetic organic chemicals not amenable to biological treatment.

f. Any wastes containing excessive amounts of nonbiodegradable oil and grease or tar.

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g. Any acidic or alkaline wastes which because of quantity, strength or unequalized flow may upset the biological process.

h. Any wastes containing in excess of one milligram per liter phenols.

i. Any wastes containing radioactive chemicals.

j. Nutrient deficient wastes which cannot meet the normal ratio of 100 BOD_5: 5 Nitrogen: 1 Phosphorous necessary for the maintenance of the biological community. An example would be corn processing wastes.

k. Any wastes that might cause excessive physical deterioration of the equipment, piping or structures.

l. Any wastes with a closed cup flashpoint of less than 140 degrees Fahrenheit.

m. Any other waste which may be defined as an incompatible pollutant.

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14.4.2 Pre-Design Meeting

It is recommended that for treatment works projects a pre-design meeting be held, with the applicant, design engineer, and the Department being in attendance. The purposes of this meeting would include:

- discussion of changes subsequent to engineering report or facilities plan approval,
- deviations from design standards,
- schedule of submittal and review, and
- facility reliability requirements determination.

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14.4.3 Required Engineering Data for New Process, Equipment and Application Evaluation

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The policy of the Department is to encourage rather than obstruct the development of any new methods or equipment for treatment of wastewater. The lack of inclusion in the design standards of some types of wastewater treatment processes or equipment should not be construed as precluding their use. The Department may approve other types of wastewater treatment processes and equipment under the condition that the operational reliability and effectiveness of the process or device shall have been demonstrated with a suitably-sized prototype unit operating at its design load conditions. The specific information required by the Department to demonstrate operational reliability and effectiveness will depend upon the process or device under consideration. Information which may be required includes:

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a. Monitoring observations, including test results and engineering evaluations, demonstrating the efficiency of such processes or equipment.

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b. Detailed description of the test methods.

c. Testing, including appropriately composited samples, under various ranges of strength and flow rates (including diurnal variations) and waste temperatures over a sufficient length of time to demonstrate adequate performance under climatic and other conditions which may be encountered in the area of the proposed installations. A control group may be required to demonstrate effectiveness.

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d. Other appropriate information.

The Department may require that appropriate testing be conducted and evaluations be made under the supervision of a competent process engineer other than the one employed by the manufacturer or patent holder. All required reports and proposals for testing and engineering evaluation of new processes, equipment and applications shall be prepared by a licensed engineer.

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A proposal for testing and engineering evaluation as a minimum should include the following:

-- Goals, objectives and benefits with an explanation as to why a pilot study or field demonstration project is needed to obtain additional engineering data

-- Literature search identifying key design parameters and related experience

-- A description of the proposal with schematic diagrams, pictures, drawings or any other important information

-- Identification of associated environmental impacts, both direct and indirect

-- Sampling and testing protocol

-- Cost analysis for study and closure

-- Complete schedule for testing and evaluation including start, completion and submittal of summary report

14.4.4 Design Period

14.4.4.1 General

The design period shall be clearly identified in the engineering report or facilities plan. The normal design period for municipal wastewater facilities is 20 years beyond the date of completion of construction. Use of a shorter design period must be justified and a schedule of action submitted which identifies future improvements to avoid effluent quality violations caused by growth.

Industrial facilities shall, as a minimum, be sized to adequately treat wastewater produced during the maximum projected production period.

14.4.5 Hydraulic Design

14.4.5.1 Critical Flow Conditions, Municipal

The following four flow conditions are critical to the design of the treatment plant:

a. Average Dry Weather (ADW) flow - the daily average flow when the groundwater is at or near normal, runoff from rainfall or snowmelt is not occurring and seasonal high hydraulic loading periods are occurring (e.g., recreational areas, campuses, industrial facilities).

   The period of measurement for this flow should extend for as long as favorable conditions exist up to 30 days if possible. Generally, the month of January may be assumed representative of the condition when runoff from rainfall or snowmelt is not occurring.

b. Average Wet Weather (AWW) flow - The daily average flow for the wettest thirty (30) consecutive days for mechanical plants or for the wettest 180 consecutive days for controlled discharge lagoons.

c. Maximum Wet Weather (MWW) flow - the total maximum flow received during any 24 hour period when the groundwater is high and runoff is occurring.

d. Peak Hourly Wet Weather (PHWW) flow - the total maximum flow received during one hour when the groundwater is high, runoff is occurring, and the domestic, commercial and industrial flows are at their peak. The domestic/commercial peak hour flow

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The peak hourly wet weather flow shall be used to evaluate the effect of hydraulic peaks on the design of pumps, piping, clarifiers, and any other flow sensitive aspects.

Initial low flow conditions must be evaluated in the design to minimize operation problems with freezing, septicity, flow measurements and solids dropout.

14.4.5.2 Existing System, Municipal

Where there is an existing system, the volume and strength of existing flows shall be determined. The flow determination shall include, but not be limited to, all four (4) flow conditions listed in subsection 14.4.5.1. The strength determination shall include both dry weather and wet weather conditions. Composite 24 hour samples proportional to flow shall be taken to be accurately representative of the strength of the wastewater. At least five years of flow data should be taken as the basis for the preparation of hydrographs for analysis to determine the flow conditions of the system. The increment of design flow for projected population growth shall be based upon the same criteria listed below for new systems.

14.4.5.3 New Systems, Municipal

The design for wastewater treatment plants to serve new collection systems shall be based on an average wet weather flow of 100 gallons per capita per day for residential and commercial flow plus 20 gallons per capita per day for out-of-town students plus industrial flow plus any abnormally large commercial operation (e.g., shopping centers, large volume restaurants, or truck stops). Exceptions may be made on a case-by-case basis where there is an existing water supply with adequate available water use data or where there is data from similar existing wastewater systems that can be utilized for new collection systems if adequate water use data from a water supply does not exist. However, in such cases, thorough investigation and adequate documentation shall be made to establish the reliability and applicability of such data.

14.4.5.4 Critical Flow Conditions, Industrial

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Flow and loads from industrial sources may vary significantly during a day, a week or a month due to production patterns. In designing the facility, the flow rate which occurs during the time period of discharge must be considered. This flow rate is defined as the rated flow.

The following flow conditions must be considered in the design of the treatment facility:

a. Average Rated Flow (30-Day) - The average rated flow which is expected to occur during production days in a 30 consecutive day period.

b. Maximum Day Rated Flow - The maximum rated flow expected to occur during a single 24-hour period.

c. Peak Hour Flow - The maximum flow which is expected to occur during a one hour period.

Other flows must be considered when they are critical to the sizing and operation of the treatment process. When determining the critical flow conditions, the following components shall be considered, as a minimum.

- Production Flows - for existing facilities, a minimum of one year of flow data shall be used for determining critical flows. This data shall be correlated with production data. For new facilities, the design flows shall be based on similar operating facilities, proposed operation mode, federal development documents for effluent limitations and new source performance data.

- Sanitary Flows - A minimum of 10 gallons per worker per shift per day shall be utilized. Higher values with suitable documentation shall be used if shower and cafeteria facilities are present.

- Contaminated Storm Runoff - If direct treatment of contaminated storm runoff is to be included, these flows shall be estimated using a rational method.

The treatment plant must be designed to meet the effluent limitations discussed in Section 14.3. The peak hourly flows must be considered in evaluating unit processes, pumping, piping, etc.

Initial low flow conditions must be evaluated in the design to minimize operational problems with freezing, septicity, flow measurements and solids dropout.

14.4.5.5 Flow Equalization

Facilities for the equalization of flows and organic shock load shall be considered when the ratio of peak hourly wet weather flow to average wet weather flow is three (3) or more. If flow equalization is not employed under these circumstances, an explanation must be included, outlining how the plant will handle this transition from average wet weather design flow to peak hourly wet weather design flow.

Wet weather flow equalization basin sizing shall consider the maximum hydraulic capacity of the treatment plant, critical flow conditions, snowmelt, rainfall with ten year or less frequent recurrence intervals, high groundwater, operating permit requirements and permitting restrictions for sanitary sewer extensions. The added wet weather flow from subsequent storms or other causes of infiltration and inflow that may occur prior to complete draining of the storage/detention basins, or tanks, shall be considered. Heat loss which may inhibit nitrification processes and high suspended solids from algae shall be considered when the maximum hydraulic capacity of the plant is less than the MWW design flow. In no case shall the maximum hydraulic capacity of the plant be less than the AWW design flow.

Table 14.1
Rainfall (inches) for 25-year Recurrence Interval in Iowa*

Location and Duration	1-hour	24-hour	10-day
Northwest	2.40	5.11	8.02
North Central	2.51	5.33	8.93
Northeast	2.40	5.11	8.29
West Central	2.48	5.27	8.24
Central	2.42	5.15	8.61
East Central	2.55	5.42	8.25
Southwest	2.61	5.56	9.00
South Central	2.72	5.78	8.99
Southeast	2.66	5.67	8.45

* Rainfall Frequency Atlas of the Midwest by Floyd A. Huff and James R. Angel (1992)

14.4.6 Organic Design

14.4.6.1 Domestic Loadings

When an existing treatment works is to be upgraded or expanded, the organic design shall be based upon the actual strength of the

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wastewater as determined from the measurements taken in accordance with Section 14.4.5.2, with an increment for growth. This growth increment shall be based on the design criteria for new systems stated below. A loading rate of 0.17 pounds BOD_5 per capita per day and 0.036 lbs TKN per capita per day may be used in lieu of actual loading rates whenever such loading rates are less than 0.17 pounds BOD_5 per capita per day and 0.036 lbs TKN per capita per day, respectively.

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Domestic waste treatment design to serve new collection systems shall be based on at least 0.17 pounds of BOD_5 per capita per day, 0.036 lb TKN per day and 0.20 pounds of suspended solids per capita per day plus 0.05 pounds of BOD_5, 0.01 pounds of TKN, and 0.05 pounds of suspended solids per out-of-town student per day.

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When garbage grinders are used in areas tributary to a domestic treatment plant, the design basis should be increased to 0.22 pounds of BOD_5 per capita per day, 0.046 lbs TKN per capita per day and 0.25 pounds of suspended solids per capita per day.

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Domestic waste treatment plants that will receive industrial wastewater flows shall be designed with additional capacity for these industrial wasteloads.

14.4.6.2 Industrial Loadings

The design loadings of industrial wastewater treatment works shall be based on actual sampling in accordance with Section 14.4.5.4, data from similar industrial facilities, or federal development documents for effluent limitation guidelines and new source performance requirements.

The treatment facility must be designed to meet the effluent limitations discussed in Section 14.3. In addition, high concentrations for short periods of time or diurnal variation of organic loads must be addressed if such peaks or variation adversely affect a unit process, particularly small plants and periodic processes.

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14.4.7 Conduits

All piping and channels shall be designed to carry the maximum expected flows into these conduits or channels without flooding. Bottom corners of the channels, except final effluent channels, must be filleted. Conduits shall be designed to avoid creation of pockets and corners where solids can accumulate. The use of shear gates, stop plates or stop planks is permitted where they can be used in place of gate valves or sluice gates. Corrosion resistant materials shall be used for valves, plates and gates. Pipes subject to clogging shall be provided with means for mechanical cleaning and flushing.

14.4.8 Design Details

14.4.8.1 Unit Bypass During Construction

Final plan and specification documents shall identify or require a construction sequence for uninterrupted operation of the existing plant during construction so as to maintain preconstruction treatment levels or meet all provisions of the National Pollutant Discharge Elimination System permit.

Approval of final plan and specification documents in no way relieves the applicant of the responsibility for complying with local, state, and federal laws, ordinances, regulations or other requirements applicable to the facility.

14.4.8.2 Drains

A means shall be provided to dewater each unit in the process. This shall be accomplished by means of gravity drains or pumping. The drainage must receive a degree of treatment which will allow for discharge in compliance with the facilities' permit limitations.

14.4.8.3 Buoyancy

Suitable methods shall be included in the design to prevent flotation of structures in areas subject to high groundwater.

14.4.8.4 Pipe Identification

In order to facilitate identification of piping, it is required that process piping be clearly identified by labeling or color coding. Appendix I presents a recommended color scheme for purposes of standardization.

14.4.8.5 Operating Equipment

A complete outfit of tools, accessories, and spare parts necessary for the plant operator's use should be provided. Readily-accessible storage space and workbench facilities should be provided in non-lagoon facilities.

14.4.8.6 Erosion Control During Construction

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Effective site erosion and sediment control shall be provided during construction. All temporary erosion and sediment control measures shall be removed or replaced with permanent measures after construction.

14.4.8.7 Grading and Landscaping

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Upon completion of plant construction, the ground shall be graded and seeded or sodded. Surface water shall not be permitted to drain into any unit.

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14.4.8.8 Sludge Disposal During Construction

The final plan and specification documents where an existing treatment unit is abandoned or upgraded shall identify or require an acceptable plan for sludge stabilization, holding and final disposal. Sludge removed from an existing treatment unit may be stored on site for a period not exceeding one year after completion of plant construction. Chapter 567 IAC 67 contains standards for land application of sewage sludge. Land application of other sludge and solid waste is regulated by Chapter 567 IAC 121.

Transferring lagoon sludge from a waste stabilization pond to a new or upgraded lagoon cell is unacceptable.

14.4.9 Plant Operability

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14.4.9.1 Unit Operation Bypassing

Bypassing shall be provided around each unit operation, except as follows. Unit operations with two or more units and involving open basins shall not be required to have provisions for bypassing if the peak wastewater flow can be handled hydraulically with the largest unit out of service. The comminution facility shall be provided with means for gravity bypassing regardless of the number and flow capacity of the comminutors.

The actuation of all bypasses shall require manual action by operating personnel. All power actuated bypasses shall be designed to permit manual operation in the event of power failure and shall be designed so that the valve will fail as is, upon failure of the power operator.

A fixed high water level bypass overflow should be provided in addition to a manually or power actuated bypass to prevent flooding in case the operator bypass fails to function or is unattended at times.

14.4.9.2 Flexibility

Where duplicate units are provided, a central collection and distribution point including proportional flow splitting shall be provided for the wastewater flows before each unit operation. Exceptions to this requirement may be made, on a case-by-case basis, when the design incorporates more than one unit process in the same physical structure.

14.4.9.3 Flow Division Control

Flow division control facilities shall be provided as necessary to insure positive, adjustable control of organic and hydraulic loading to the individual process units and shall be designed for easy operator access, change, observation, and maintenance. Where duplicate units are provided, a flow division control facility shall be designed to properly proportion flow to each unit operation so that proportioned flows are measurable.

14.5 TREATMENT FACILITY RELIABILITY CLASSES

14.5.1 Facility Reliability Classes

The Department will establish reliability classes for all new facilities and facilities undergoing major modifications in accordance with one of the following classes:

a. Reliability Class I - Includes all facilities which discharge into waters that could be permanently or unacceptably damaged by effluent which was degraded in quality for a few hours. This would include those facilities discharging into high quality waters, into waters to be protected for primary contact water uses, or into cold water streams or raw water sources for a potable water supply (Classes "A1" - primary contact recreational, "A3" - children's recreational, "B(CW)" - cold water or "C" - drinking water, 567 IAC chapter 61, Water Quality Standards).

b. Reliability Class II - Includes all facilities where a reduction in effluent quality for several days would cause a violation of the water quality standards of the receiving body of water (Classes "A2" - secondary contact recreational, "B(WW)" - warm water, "B(LW)" - lakes and wetlands or "HH" - human health, 567 IAC chapter 61, Water Quality Standards).

c. Reliability Class III - Includes all facilities which are not included in Reliability Classes I or II. This would include facilities which discharge into unclassified streams, controlled discharge lagoons, and treatment prior to land application.

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14.5.2 Unit Process Reliability Criteria

The requirements for system reliability are normally achieved by providing duplicate or multiple units for each treatment process, but reliability can also be achieved through flexibility in the design and operation of systems and components. As used in these criteria, a unit operation is a single physical, chemical or biological process.

14.5.2.1 Unit Process Reliability Criteria A

The following reliability is required for any mechanical treatment facility that is Facility Reliability Class II or III, and is required to provide secondary treatment. (Facilities with Reliability Class I are covered by Unit Process Reliability Criteria B under 14.5.2.2 or Reliability Criteria C under 14.5.2.3.)

1. Duplication of major treatment units is not required. If provided, duplication for any unit process or operation shall, as a minimum, be in accordance with the appropriate part of Process Reliability Criteria B.

2. When duplicate units are not provided, the facility shall include a pond having five (5) days storage capacity for the average wet weather flow and with the capability to bypass the pond when effluent limitations are being met. This pond may also be used for flow equalization. Provisions for returning the holding pond contents to the treatment process are required.

   The pond shall be constructed in accordance with the applicable provisions of Section 18C.7, particularly Section 18C.7.3 pertaining to sealing of the pond bottom and maximum percolation rate. Separate volumes must be provided in the pond for the five (5) days storage capacity for the average wet weather flow and for flow equalization if it is planned to use the pond for both purposes. A minimum water level of two (2) feet shall be maintained at all times. Adequate provisions must be made for the necessary valving, piping, pumping, metering, aeration and sludge removal capabilities to permit the pond to be maintained and operated in a manner to effectively perform its intended functions.

3. Sludge wasting, sludge stabilization (defined by process) and holding, and a final disposal site are required.

14.5.2.2 Unit Process Reliability Criteria B

The following reliability is required for any mechanical treatment facility providing either: 1) two stage treatment (defined as including intermediate settling) with a nitrification requirement or 2) standard secondary treatment with no nitrification requirement and is not exempted by Process Reliability Criteria A:

Deleted: or two stage nitrification

1. If primary screens are used, duplication shall be provided in accordance with the following:

   There shall be a sufficient number of units of a size such that, with the largest flow capacity unit out of service, the remaining units shall have a peak flow capacity of at least 100% of the PHWW flow (or industrial peak hour flow) to that unit operation.

2. Duplication of all primary clarifiers (if used), aeration basins, and fixed film reactors shall be provided in accordance with the following:

   There shall be a sufficient number of units of a size such that, with the largest unit out of service, the remaining units shall have a design load capacity of at least 50% of the total design loading to that unit operation.

3. Duplication of all final clarifiers shall be provided in accordance with the following:

   There shall be a sufficient number of units of a size such that with the largest unit out of service, the remaining units shall have a design load capacity of at least 75% of the total design loading to that unit operation for Facility Reliability Class I and 50% for Facility Reliability Class II or III.

4. Sludge wasting, sludge stabilization (defined by process) and holding, and a final disposal site are required.

14.5.2.3 Unit Process Reliability Criteria C

The following reliability is required for any mechanical treatment facility providing single stage combined carbonaceous oxidation and nitrification:

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1. If screens are used in lieu of primary clarifiers, duplication shall be provided in accordance with the following:

   There shall be a sufficient number of units of a size such that, with the largest flow capacity unit out of service, the remaining units shall have a peak flow capacity of at least 100% of the PHWW flow (or industrial peak hour flow) to that unit operation.

2. Duplication of all primary clarifiers (if used), aeration basins and fixed film reactors shall be provided in accordance with the following:

   There shall be a sufficient number of units of a size such that, with the largest unit out of service, the remaining units shall have a design load capacity of at least 50% of the total design loading to that unit operation.

3. Duplication of all final clarifiers shall be provided in accordance with the following:

   There shall be a sufficient number of units of a size such that, with the largest unit out of service, the remaining units shall have a design load capacity of at least 75% of the total design loading to that unit operation.

4. Sludge wasting, sludge stabilization (defined by process) and holding, and a final disposal site are required.

14.5.2.4 Unit Process Reliability Exceptions

A. An exception to the preceding reliability requirements will be made in the upgrading of an existing plant which contains one unit large enough to provide at least 100% of the total design load capacity to that unit operation. In this case no duplication is required.

B. Another exception will be made in the upgrading of an existing unit to be operated in parallel with a larger new unit. In order to consider the use of the existing unit, it must provide at least 40% of the total design load capacity of that unit operation.

14.5.3 Power Source Reliability

Two separate and independent sources of electric power shall be provided to the facilities from either from a single substation and an emergency power generator or two separate utility substations. An emergency power generator is required where both substations may lose power from storm damage. If available from the electric utility, at least one of the facility's power sources shall be a preferred source (i.e., a utility source which is one of the last to lose power from the utility grid due to loss of power generating capacity). In areas where it is projected that sometime during the design period of the facility, the electric utility may reduce

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the rated line voltage (i.e., “brown out”) during peak utility system load demands, an emergency power generator shall be provided as an alternate power source. Reliability and ease of starting, especially during cold weather conditions, shall be considered in the selection of the type of fuel for internal combustion engines. Where public utility gas is selected, the generator shall be designed so that the generator may be operated with an alternate fuel. As a minimum, the capacity of the backup power source for each Facility Reliability Class shall be:

14.5.3.1 Facility Reliability Class I

Sufficient to operate all vital components, during peak wastewater flow conditions, together with critical lighting and ventilation. Vital components include those associated with flow, treatment, pumping, metering and disinfection, and those parts of sludge handling which cannot be delayed without adverse effects on plant performance. Critical lighting and ventilation is that needed to maintain safety and perform duties associated with operation of the vital components of the plant.

14.5.3.2 Facility Reliability Class II

Same as Reliability Class I, except that vital components used to support the secondary processes (i.e., mechanical aerators or aeration basin air compressors) need not be included as long as sedimentation and disinfection are provided.

14.5.3.3 Facility Reliability Class III

Sufficient to operate the screening or comminution facilities, the main wastewater pumps, the primary sedimentation basins, and the disinfection facility during peak wastewater flow condition, together with critical lighting and ventilation.

Notes: -- This requirement concerning rated capacity of electric power sources is not intended to prohibit other forms of emergency power, such as diesel driven main wastewater pumps.

-- In cases where history of a long-term (four hours or more) power outages have occurred, backup power for providing minimum aeration of an activated sludge system will be required.

-- Lagoon systems, including aerated lagoons, will be required to provide backup power for pumping and essential lighting and ventilation. Backup power for disinfection at aerated lagoon facilities is not required if no other component at the site requires backup power.

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14.6 PLANT OUTFALL

14.6.1 Protection and Maintenance

The outfall sewer shall be so constructed and protected against the effects of floodwater, ice, or other hazards as to reasonably insure its structural stability and freedom from stoppage.

14.6.2 Sampling Provisions

All outfalls shall be designed so that a sample of the effluent can be obtained at a point after the final treatment process and before discharge to or mixing with the receiving waters. If chlorination is provided, a sampling point is also required immediately prior to chlorination.

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14.6.3 Effluent Diffuser System

Consideration shall be given to the following where an effluent diffuser system is constructed to achieve rapid and complete dispersion of the effluent with the receiving stream:

a. In general, the minimum requirements for protection of a sewer crossing under a waterway as provided in Section 12.5.11 shall be met.

b. The outfall header should be designed to carry the entire wastewater flow with no shoreline discharge. If a shoreline discharge may occur, the design engineer must describe all operating scenarios and obtain the applicable effluent limitations prior to the preparation of the engineering report or facilities plan. Multiple headers shall be considered for reliability and to ensure uninterrupted service where an effluent diffuser system is required to meet the effluent limitations established by the Department.

c. Outfall header pipe should be aligned perpendicular to the stream flow. Port spacing should be on 3 to 6 foot centers and aligned to discharge downstream. The orifice opening may be 2 inches or larger. The exit velocity shall be at least 2 feet/sec to achieve complete mixing within 25 feet of the diffuser. An alternative with equivalent mixing where the exit velocity is less than 2 feet/sec may be approved by the Department on a case by case basis.

d. Risers shall be located and designed to discharge below the low water elevation of the stream. Each riser should be aligned at 45 degrees from the vertical. A self closing valve for each riser should be provided to prevent entry of sand and mud.

e. Where the outfall header pipe extends across the entire stream, a manhole shall be provided on the opposite shore to facilitate maintenance.

f. Hazards to navigation shall be considered.

g. Location of the effluent diffuser system shall be permanently posted to clearly identify the nature and presence of the plant outfall.

14.7 ESSENTIAL FACILITIES

14.7.1 Water Supply

14.7.1.1 General

No piping, connections, or potential cross connection situations, shall exist in any part of the treatment works which, under any conditions, might cause the contamination of a potable water supply.

14.7.1.2 Direct Connections

Potable water from a municipal or separate supply may be used directly at points above grade for the following hot and cold supplies:

a. lavatory;
b. water closet;
c. laboratory sink (with vacuum breaker);
d. shower;
e. drinking fountain;
f. eye wash fountain; and
g. safety shower.

Hot water for any of the above units shall not be taken directly from a boiler used for supplying hot water to a sludge heat exchanger or digester heating unit.

14.7.1.3 Indirect Connections

Where a potable water supply is to be used for any purpose in a plant other than those listed in Section 14.7.1.2 either a break tank, pressure pump, and pressure tank or an approved reduced pressure backflow preventer (AWWA C506) is required.

Water shall be discharged to the break tank through an air gap at least six inches above the maximum flood line or the spill line of the tank, whichever is higher.

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A sign shall be permanently posted at every hose bib, faucet, hydrant, or sill cock located on the water system beyond the break tank or backflow preventor to indicate that the water is not safe for drinking.

14.7.1.4 Separate Potable Water Supply

Where it is not possible to provide potable water from a public water supply, a separate well may be provided. Location and construction of the well must comply with requirements of the Department.

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14.7.1.5 Separate Non-Potable Water Supply

Where a separate non-potable water supply is to be provided, a break tank will not be necessary, but all system outlets shall be posted with a permanent sign indicating the water is not safe for drinking.

14.7.2 Flow Measurement

Continuous flow measurement and recording shall be provided for all wastewater treatment plants serving a population equivalent (P.E.) greater than 100. A flow measurement device shall still be provided, however, and the design of the structure shall facilitate the installation of continuous flow recording equipment and automatic samplers for facilities serving less than 100 P.E.

14.7.2.1 General

Weirs shall not be acceptable for influent flow measurement except for very low flows where an “H” flume or an equivalent self-flushing flow measuring devices are not accurate. Otherwise all influent flow measurements shall be self-flushing. Self-cleaning in-channel floats may be allowed for influent head measurements. Use of floats in stilling wells is acceptable.

14.7.2.2 Requirements for Different Systems

a. Controlled discharge lagoon - Flow measurement facilities shall be provided for the total influent flow and any discharge from the lagoon. Equipment to continuously measure and record flow rates and total influent flow is required. A V-notch weir without level monitoring equipment is permitted for measuring intermittent discharges from controlled discharge facilities.

b. Flow-through treatment system - These systems must have the capability of continuously measuring and recording flow rates and total flow to the plant.

c. If flow bypasses a portion of the plant or if the influent flow is significantly different from the effluent flow, then additional flow measurement and recording is required.

d. Flow measuring devices for determining recycle flow, return sludge flow, and waste sludge volume shall also be provided.

e. Total retention facilities - A means for accurate determining the total daily flow into the facility is required.

14.7.2.3 Magnetic Flow Meter

A magnetic flow meter on a lift station force main with automatic continuous recording equipment will generally be an acceptable method of providing continuous flow monitoring.

14.7.2.4 Elapsed Time Meters

Elapsed time meters (ETMs) with an event recorder on lift station pump controls will generally be an acceptable method of providing continuous flow monitoring for the construction of controlled discharge lagoons and for flow-through treatment facilities serving 1000 P.E. or less, but only when it can be shown that the installation of a flume with automatic continuous recording equipment, or its equivalent, is an impractical alternative.

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14.7.2.5 Reliability and Accuracy

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Flow measurement equipment shall accurately measure flow with a maximum deviation of ± 10 percent of true discharge rates throughout the range of discharge levels of the flow measuring device plus a deviation of ± 3 percent of the maximum design flow for the transmitting-recording equipment.

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14.7.3 Sampling Equipment

Effluent composite sampling equipment shall be provided at all mechanical plants and at other facilities where necessary to meet discharge monitoring requirements. Composite sampling equipment shall be provided as needed for influent sampling and for monitoring plant operations. The influent sampling point should be located at the plant and prior to any process return flows from treatment units. If practical or required, the design shall flow proportion all composite 24-hour samples.

14.8 SAFETY

It is the facility owner's responsibility to ensure that the Occupational Safety and Health Administration (OSHA), the National Electric Code and other applicable building and construction codes and requirements are met during construction and subsequent operation. During construction this requirement may be met by including references to OSHA, NEC and other applicable building and construction codes in the contract documents.

14.9 LABORATORY

14.9.1 Minimum Required Laboratory Analysis Capability

Careful consideration should be given to the laboratory facilities needed for the operational control of each plant. Analyses shall be utilized which will evaluate the efficiency of the entire treatment facility as well as the efficiency of individual treatment units. The Department has established the minimum self monitoring requirements and analytical procedures for wastewater treatment plants (Chapter 63 - Monitoring, Analytical and Reporting Requirements). Additional monitoring may be required dependent upon a case-by-case evaluation of the potential impact of certain wastewater, industrial contributions to the plant, complexity of the treatment process, or other factor which requires more stringent operational control.

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14.9.2 Facilities

All treatment works shall include a laboratory for making the necessary analytical determinations and operating control tests, except in individual situations where operational testing is minimal or not required and self-monitoring analyses are to be performed off-site. The laboratory shall have sufficient size, bench space, equipment and supplies to perform all on-site self-monitoring analytical work required by the operation permits, and to perform the process control tests necessary for management of each treatment process included in the design. The facilities and supplies necessary to perform analytical work to support industrial waste control programs will normally be included in the same laboratory. The laboratory size and arrangement must be sufficiently flexible and adaptable to accomplish these assignments. Recommended laboratory guidelines are contained in Appendix II.

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CHAPTER 14

APPENDIX I

RECOMMENDED PROCESS PIPING COLOR CODING

Raw sludge line - brown with black bands (or black)

Digested sludge line - black

Sludge recirculation suction line - brown with yellow bands

Sludge draw off line - brown with orange bands

Sludge recirculation discharge line - brown

Sludge gas line - orange (or red)

Natural gas line – red with black bands

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Nonpotable water line - blue with black bands (or light blue with red bands)

Potable water line - blue

Chlorine line - yellow

Sulfur Dioxide – yellow with red bands (or light green with yellow bands)

Sewage line – dark gray (or green)

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Compressed air line - dark green

Process air line - light green

Water line for heating digesters or buildings - blue with a six inch red band spaced 30 inches apart

Fuel oil/diesel - red

Plumbing drains and vents - black (or gray)

Polymer - orange with green bands

Reuse water line - purple

If labeling is used the contents should be clearly indicated on the piping in a contrasting color.

Adopted March 22, 1984
Amended May 20, 1987

Adopted March 22, 1984
Amended May 20, 1987

CHAPTER 14

APPENDIX II

RECOMMENDED LABORATORY GUIDELINES

Location and Space

The laboratory should be located on ground level, easily accessible to all sampling points, with environmental control as an important consideration. It shall be located away from vibrating machinery or equipment which might have adverse effects on the performance of laboratory instruments or the analyst or shall be designed to prevent adverse effects from vibration. A minimum of 180 square feet of floor space should be provided for activated sludge, physical-chemical and advanced wastewater treatment plants; a minimum of 150 square feet of floor space should be provided for other type of treatment plants; and a minimum of 400 square feet of floor space should be provided for laboratories having a full time laboratory chemist. Bench-top working surface should occupy at least 35 percent of the total floor space.

Minimum ceiling height should be eight feet six inches. If possible, this height should be increased to provide for the installation of wall-mounted water stills, distillation racks, and other equipment with extended height requirements.

Additional floor and bench space should be provided to facilitate performance of analysis of industrial wastes, as required by the operation permit and the utility's industrial waste pretreatment program. The above minimum space does not provide office or administration space.

Materials

Ceilings

Acoustical tile should be used for ceilings except in high humidity areas, where they should be constructed of cement board or equal.

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Walls

Wall finishes should be light in color and nonglare.

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Floors

Floor surfaces should be either vinyl or rubber, fire resistant, and highly resistant to acid, alkalines, solvents, and salts. Floor finishes should be of a single color for ease of locating small items that have been dropped.

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Doors

Two exit doors should be located to permit a straight egress from the laboratory, preferably at least one to outside the building.

Panic hardware should be used. They should have large glass windows for easy visibility of approaching or departing personnel.

Automatic door closers should be installed; swinging doors should not be used.

Flush hardware should be provided on doors if cart traffic is anticipated. Kick plates are also recommended.

Cabinets and Bench Tops

Wall-hung cabinets are useful for dust-free storage of instruments and glassware. Units with sliding glass doors are preferable. They should be hung so the top shelf is easily accessible to the analyst. Thirty inches from the bench top is recommended.

One or more cupboard-style base cabinets should be provided for storing large items; however, drawer units are preferred for the remaining cabinets. Drawers should slide out so that entire contents are easily visible. They should be provided with rubber bumpers and with stops which prevent accidental removal. Drawers should be supported on ball bearings or nylon rollers which pull easily in adjustable steel channels. All metal drawer fronts should be double-wall construction.

All cabinet shelving should be acid-resistant and adjustable from inside the cabinet. Water, gas, air, and vacuum service fixtures; traps, strainers, overflows, plugs and tailpieces; and all electric service fixtures shall be supplied with the laboratory furniture.

Generally, bench-top height should be 36 inches. However, areas to be used exclusively for sit-down type operations should be 30 inches high and include kneehole space. One-inch overhangs and drip grooves should be provided to keep liquid spills from running along the face of the cabinet. Tops should be finished in large sections, 1-1 1/4 inches thick. They should be field joined into a continuous surface with acid, alkali, and solvent-resistant cements which are at least as strong as the material of which the top is made.

Hoods

Fume hoods to promote safety and canopy hoods over heat-releasing equipment, if provided, should be installed near the area where most laboratory tests are made.

Sinks

The laboratory should have a minimum of two sinks (not including cup sinks). At least one of them should be double-wall with drainboards. Additional sinks should be provided in separate work areas as needed, and identified for the use intended.

Sinks should be made of epoxy resin or plastic material with all appropriate characteristics for laboratory applications. The sinks should be constructed of material highly resistant to acids, alkalies, solvents, and salts, and should be abrasion and heat resistant and nonabsorbent.

Traps should be made of glass, plastic, or lead and easily accessible for cleaning. Waste openings should be located toward the back so that standing overflow will not interfere. All water fixtures on which hoses may be used should be provided with vacuum relief valves to prevent contamination of water lines.

Ventilation and Lighting

Laboratories should be separately air conditioned, with external air supply for 100% make-up volume. In addition, separate exhaust ventilation should be provided. Ventilation outlet locations should be remote from ventilation inlets.

Air intake should be balanced against all supply air that is exhausted to maintain an overall positive pressure in the laboratory relative to atmospheric and other pressurized areas of the building which could be the source of airborne contaminants.

Good lighting, free from shadows, is important for reading dials, meniscuses, etc., in the laboratory.

Gas and Vacuum

Natural gas should be supplied to the laboratory. Digester gas should not be used.

An adequately-sized line source of vacuum should be provided with outlets available throughout the laboratory.

Equipment, Supplies and Reagents

The laboratory shall be provided with all of the equipment, supplies, and reagents that are needed to carry out all of the facility's analytical testing requirements. Operation permit, process control, and industrial waste monitoring requirements should be considered when specifying equipment needs. References such as Standard Methods and the U.S.E.P.A. Analytical Procedures Manual should be consulted prior to specifying equipment items.

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Microscope

A binocular or trinocular microscope with a 20 watt halogen light source; phase contrast condenser; mechanical stage; 10, 40 and 100 X phase contrast objectives; wastewater reticle eyepiece and centering telescope is recommended for process control at activated sludge plants.

Balance and Table

An analytical balance, single pan 0.1 milligram sensitivity type, shall be provided for plants performing laboratory tests including biochemical oxygen demand, suspended solids and fecal coliform analysis. A heavy balance table which will minimize vibration of the balance is recommended. It shall be located as far as possible from windows, doors or other sources of drafts or air movements.

Power Supply Regulation

To eliminate voltage fluctuation, electrical lines supplying the laboratory should be controlled with a constant voltage, harmonic neutralized type of transformer. This transformer should contain less than 3% total root mean square (RMS) harmonic content in the output, should regulate to ± 1% for an input range of ± 15% of nominal voltage, with an output of 118 volts. For higher voltage requirements, the 240-volt lines should be similarly regulated.

Electrical devices in the laboratory not requiring a regulated supply (i.e., ordinary resistance heating devices) that are non-portable may be wired to an unregulated supply.

Water Still

An all-glass water still, with at least one gallon per hour capacity should be installed complete with all utility connections.

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